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THE Rh FACTOR IN HEMOLYTIC DISEASE OF THE NEWBORN

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THIS article is not intended as a comprehensive nor a critical review of the relationship of the Rh factor to hemolytic disease of the newborn, but rather as an introduction to the paper on the "Morality of the Rh factor" to be given by Father Schwitalla. In this paper I will discuss the development of the work which has been done on the Rh factor of the blood in humans, discuss briefly its relationship in hemolytic disease of the newborn and indicate the value of Rh studies particularly in relationship to pregnancy.

In their experiments during and just prior to 1937, Landsteiner and Wiener produced an antibody in rabbits by the injection of monkey blood as an antigen. This new antibody not only agglutinated the red blood cells of monkeys but in addition agglutinated those of certain white humans. This indicated a new factor present in the red cells of certain humans and because it had been developed by the use of the blood of the macacus rhesus monkey the name Rh was given it to indicate the original source of the antigen. Further studies indicated that approximately 85% of white humans possessed this Rh agglutinogen in their red cells and in the other 15% it was absent. They were accordingly designated as Rh positive (containing the Rh agglutinogen) and Rh negative (an absence of the Rh agglutinogen). This newly described factor was not initially considered to be of great importance until in 1939 Wiener and Peters found the antibody to this newly discovered Rh factor in three patients who had severe hemolytic reactions following transfusions of otherwise compatible blood. These patients apparently had been immunized or better, iso-immunized, to the rhesus or Rh factor. Levine and his coworkers then noted the very frequent occurrence of transfusion reactions in women who had stillbirths or infants with erythroblastosis fetalis. At this time Levine postulated the very interesting theory that an Rh negative mother who bears an Rh positive detus became sensitized in some manner to the Rh factor of the fetus and subsequently developed antibodies in her blood to the Rh factor. These antibodies in turn passed through the placenta and into the fetal blood circulation with resulting agglutination and hemolysis of the fetal blood. The intra-uterine hemolysis in the infant then would account for the severe symptoms which were found to be present in erythroblastosis fetalis. Because erythroblastosis fetalis in its varied forms was demonstrated to be the result of fetal and neo-natal hemolysis it is referred to today as hemolytic disease of infants and newborns.

The antibody produced by the artificial immunization of rabbits to monkey blood has certain characteristics which are identical with that of the antibody produced in women delivering infants with hemolytic disease. The antibody produced in humans has been designated anti Rh_0 and the erythrocytes which are agglutinated by this antibody are designated as the Rh_0 type. Later it was found that there were two and perhaps more factors present in human iso-immunization which were not present in the original immunization of rabbits with monkey blood.

The two additional antibodies which have been detected in humans are given the designations anti Rh^1 and anti Rh^{11} and accordingly, these sera detect the presence or absence of the corresponding three Rh factors in human blood, namely, Rh_0 Rh^1 and Rh^{11}. By the use of these three agglutinating sera we can thus differentiate eight Rh types in the first four of which the Rh_0 factor is absent and in the last four is present, as follows:

Clinically Rh negative
Rh negative, Rh^1, Rh^{11}, Rh^1 Rh^{11}
Clinically Rh positive
Rh_0, Rh, (Rh_0^{11}), Rh_2 (Rh_0^{11}), Rh_1 Rh_2

in this scheme the Rh_1 and Rh_2 factors are considered to be combinations of the Rh_0 and Rh^{11} and Rh_0 respectively as Rh_0^1 and Rh_0^{11}.

Since the Rh_0 factor which corresponds to the original anti-rhesus serum is by far the most antigenic and therefore the most important clinically, it is the presence or absence of this factor which is determined by most of the antiserum on the commercial market. For clinical purposes we may consider any blood in which the Rh_0 factor is present to be Rh positive and those in which the Rh_0 factor is absent to be Rh negative. This is true in approximately 85% of individuals while the rarer Rh Factors account for only approximately 2% of the white population.

The presence or the absence of the Rh factor in the erythrocytes is hereditarily determined and the Rh factor is transmitted to offspring as a Mendelian dominant by a pair of allelic genes, Rh (dominant) and rh (recessive). Since every individual possesses a pair of genes from every allelic series of genes one from the father and one from the mother, there are thus three genotypes possible.

RH FACTOR TRANSMISSION

TYPES	GENOTYPES	
Rh—	rh rh	Homozygous
Rh+	Rh Rh	Homozygous
Rh+	Rh rh	Heterozygous

From this we can see that for the entire group of eight Rh types, there are twenty-one possible genatypes. Since the type of blood is determined by the character of the blood of the parent and a gene inherited from each of the father and the mother, the Rh factor is inherited as in the following chart.

INHERITANCE OF THE RH FACTOR

PARENT		PARENT		CHILD	
TYPE	GENOTYPE	TYPE	GENOTYPE	TYPE	GENOTYPE
Rh—	rh rh	Rh—	rh rh	Rh— (100%)	rh rh
Rh+ —	Rh Rh	Rh—	rh rh	Rh+ (100%)	Rh rh
Rh+	Rh rh	Rh—	rh rh	Rh+ (50%)	Rh rh
Rh+	Rh Rh	Rh+	Rh Rh	Rh+ (100%)	Rh Rh
Rh+	Rh rh	Rh+	Rh rh	Rh+ (25%)	Rh Rh
				Rh+ (50%)	Rh rh
				Rh— (25%)	rh rh

Levine has described another factor which because of its reciprocal relationship to the Rh factor has been described as the Hr factor. Because of its peculiar reciprocal relationship to the Rh factor, the Hr factor by its presence or absence in the erythrocytes has been used to distinguish homozygous and heterozygous Rh positive blood. In this test erythrocytes from homozygous individuals are not agglutinated by the anti Hr serum.

Recently it has been found that the Rh factor as an antigen may produce more than one type of antibody. This second type of antibody produced is sometimes designated as a blocking antibody which specifically unites with and coats the surface of the Rh positive erythrocytes without inducing physical effective agglutination. In other words the antibody is incomplete because only the first stage of the reaction occurs. The specifically coated Rh positive erythrocytes are now incapable of reacting with the usual anti Rh agglutin and as a result special tests have been described by means of which it is possible to detect the anti Rh agglutin in the usual manner and the so-called blocking antibody as well. The blocking antibody according to Wiener, is of more importance in the production of hemolytic disease than the Rh antibody. The blocking antibody has a smaller molecule and theoretically passes the placental barrier more readily, and it is strongly antigenic.

Many examples of iso-immunization by repeated transfusions of Rh positive blood into Rh negative recipients are recorded in the literature. Levine has found a definite history of prior transfusions in sixteen of a series of twenty-five cases of hemolytic disease of the newborn in the first born of Rh negative women. Levine has further emphasized the importance of small immunizing doses of blood and has calculated that only .13.cc. of fetal blood is required to immunize the Rh negative mother. As a result of these and other observations we must assume that once an individual is immunized to the Rh factor, either by repeated transfusions, intramuscular injection of blood or by pregnancy, he must be considered as immunized for the remainder of his natural life, and further that with each succeeding exposure to Rh positive blood he will probably produce increasingly greater quantities of antibody. Accordingly, it is important in pediatric practice to administer only Rh negative blood to Rh negative female infants and to minimize the intramuscular injection of blood from any donor who is Rh positive. One or more transfusions of Rh positive blood administered to an Rh negative female infant may prevent her many years later from having one or more normal Rh positive infants. Further, Rh testing is particularly indicated if repeated transfusions are anticipated especially in young females before and during the childbearing period, and in some, past the menopause, if they have borne children, particularly if there is any evidence in the history which would indicate previous immunization to the Rh factor. Humans, as well as experimental animals, differ considerably in the ease with which they become sensitized to various antigens. In humans this is indicated by the fact that approximately one out of ten marriages are of the serologic sequence (Rh positive male, Rh negative female) which is capable of producing infants with hemolytic disease. Actually only one in approximately two-hundred fifty newborns is so affected. Further, sensitization in pregnancy probably increases only with repeated exposures to the Rh factor as an antigen and as a consequence hemolytic disease in the first borne is relatively uncommon unless there is a history of previous exposure to the Rh factor. As a rule we can anticipate one, two, or perhaps more perfectly normal children who may be Rh positive even though the subsequent children are so affected. Hemolytic disease of the newborn is gradually increasing in importance because of two essential factors: first, the diagnosis is made more readily than formerly because of increased diagnostic acumen and additional criteria upon which a diagnosis can be based; and secondly, the lowering mortality in hemolytic disease because of improved methods in treatment such as prompt transfusion. The diagnosis of hemolytic disease of the newborn usually does not present much difficulty. However, there are a number of diseases which must be kept in mind and in the differential diagnosis we must consider congenital syphilis, intra-uterine or post-partum infections of the infant, certain hemorrhagic disease of the newborn, very rarely congenital malformation of the bile ducts and physiologic icterus which very frequently occurs in newborn babies.

If we recall that there are various clinical types of hemolytic disease of the newborn, we are in a much better position to make the proper clinical diagnosis. These forms of hemolytic disease include fetal hydrops which is the most severe and has a mortality rate of approximately 100%, the jaundiced form, and the jaundiced form anemia and finally, the form which is manifest simply as a hemorrhagic diathesis. These various forms are apparently related genetically and etiologically.

The evidences of hemolytic disease in the infant may be found in the mother or in the infant. In the parents we would expect the serologic sequence of an Rh positive father and an Rh negative mother. If the mother becomes immunized to the blood of the fetus, there will be Rh antibodies in her blood serum. In some there may possibly be a history of previous transfusions especially with Rh positive blood or the intramuscular injection of blood during infancy. During pregnancy there may be evidences of hydramnios, death of the fetus and at birth there is frequently yellow amniotic fluid and enlargement of the placenta. The presence of Rh antibodies in the mother's blood can be possibly used in a limited way to predict the occurrence of hemolytic disease in the infant. If no antibody is found or if small amounts are found regularly the infants will usually have no evidence of hemolytic disease. If large amounts of antibody or small amounts of antibody are repeatedly found, the infants may develop some form of hemolytic disease.

Early appearance of large amounts of antibody generally indicates a serious prognosis for the infant. If these observations are repeatedly confirmed, it will allow us to predict in advance the form and approximate severity of the hemolytic process and as a consequence institute treatment of the infant at an earlier date. In the infant, at birth, or developing soon after birth, we find a jaundice, edema, hepatomegaly and splenomegaly with a normoblastic picture in the blood and bone marrow smears.

These evidences vary considerably with the different forms of the disease mentioned above. At necropsy examination we find evidences of a hyperplastic normoblastic bone marrow with foci of extra-medullary hematopoiesis in the liver, spleen, and kidneys. Oftentimes in the lungs we find hemocytoblasts in the pulmonary capillaries. In some of the more severely affected infants there is evidence of kernicterus and usually evidences of enlargement of the liver and of the spleen.

In hemolytic disease immediate transfusion with adequate amounts of Rh negative blood is, at present, the treatment of choice. If Rh negative blood is used there is no hemolysis of the transfused blood by the antibody in the infant. The infant is not breast fed because of the possibility of continued transfer of the Rh antibody from mother to infant in the breast milk. For the most part repeated small transfusions have been used quite successfully; however, Wiener has recommended massive replacement transfusions in which the infant is bled of his blood through an artery and at the same time blood from an Rh negative donor is given intravenously. The results of treatment by small transfusions in our most recent 18 cases of hemolytic disease may be seen in the following chart:

HEMOLYTIC DISEASE OF THE NEWBORN

(Summary of Recent Cases)

Cases	No.	Deaths
Icteric	16	2
Hydrops	1	0
Adm. from another hospital	1	1
Total	18	3

This is obviously a much lower mortality rate than we might anticipate without the benefit of immediate and adequate transfusions. In 16 of these 18 cases the transfusion data are summarized on the accompanying chart:

INTRA-OSSEOUS TRANSFUSION DATA

(16 cases)

Transfusions	56
No. per case (Aver.)	3.25
Cc. per case (Aver.)	188.5

We have used the intra-osseous as well as the umbilical route in our patients for convenience and ease of transfusion. For infants in whom hemolytic disease was anticipated we have been able to use the umbilical cord very successfully. With all of these facts in mind I would like to suggest the following policy in pregnant women with regard to the Rh factor.

SUGGESTED POLICY IN PREGNANCY

1. All obstetric patients are Rh typed at the time of first visit. In the Rh negative group also type husband, other children, and if possible the parents of husband. Do Hr typing on husband if available.
2. In all Rh negative females with Rh positive husbands do anti-RH and blocking tests at 2 week intervals beginning at 24th week of gestation and at 1 week intervals after 30 weeks gestation.
3. Have Rh negative blood available for immediate transfusion of all infants delivered of women with anti Rh or blocking antibodies.

4. In all women with Rh antibodies study the infant carefully at birth noting the size and weight of placenta, presence of hydramnios, color of amniotic fluid and repeated blood smears on infant.

If these various suggestions are followed it is entirely probable that hemolytic disease can be anticipated with some degree of certainty and adequate therapeutic steps carried out. I mention two more items not because they are of clinical importance at this time but because they may be theoretically important at a later date. If an individual is simultaneously injected with two antigens he will react almost entirely to the stronger of these two antigens. As a consequence it is theoretically possible to give during early pregnancy, a strong antigen and inhibit sensitization to the Rh factor. At present we are unable to predict which women are susceptible to Rh sensitization.

The second observation is based on the work of Homberger who has found in experimental animals immunized with rhesus cells that the simultaneous administration of sodium salicylate will inhibit the production of antibodies. It is impossible to use this drug at present because of the high toxicity of the drug but the observation is of importance because it is entirely possible that other chemical agents may be found which will inhibit the production of the Rh antibodies but will not have the high toxicity of large doses of sodium salicylate.

SUMMARY:

I have reviewed the recent literature concerning the Rh factor and its relationship to hemolytic disease of the newborn. As we study this problem more thoroughly we become impressed particularly with potential sensitization of young females by indiscriminate use of blood. It is probable that we should omit the use of intra-muscular blood, and Rh positive blood to Rh negative young female infants. When patients come to us worried because of incomplete information based on popular accounts of this subject in lay magazines we can assure them that not all women become sensitized equally and hence there is a strong probability that they will never deliver an infant with hemolytic disease even though the serologic sequence is consistent. Further, that if they should develop this form of sensitivity they will probably have several normal children before they have one with hemolytic disease, and if the father is heterozygous Rh positive 50% of the children will be born as Rh negative infants and hence free of hemolytic disease. If the infants are born with hemolytic disease and especially if this is anticipated, immediate prompt treatment improves the prognosis immeasurably and will result in normal living children even though they have hemolytic disease in infancy. Further work can be done along the line suggested by double immunization and the use of chemical reagents to diminish the capability of forming antibodies.

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THE MORAL ASPECTS OF THE Rh FACTOR

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THE essentially civilizing and culturing influences of moral theology and Christian ethics arise from the fact that they emphasize so incessantly and so insistently in our lives the human and the divine values of our actions, that a person who lives under the bright and challenging light of moral ideals and ethical realities can never be oblivious of their omnipresent and their omnipotent dynamism. A person who is aware of the importance of the dictates of morality and of moral theology can never successfully ignore them; can never successfully escape the power of their influence; can never expect to escape beyond the reach of the warning finger of conscience or the threatening finger of God's long suffering, or beyond the glowing warmth of the God-man's love.

There are actions which in themselves are pronounced to be unworthy of a man by the dictates of one's own conscience. There are other actions which of themselves merit the full approval of one's own conscience. There is a third class of actions which derive their moral value not so much from their own selves but from the circumstances surrounding them, circumstances which are in many instances entirely within the limits of control by the individual and which, therefore, achieve a moral significance by reason of the individual's attitude towards them.

In one sense of the word, the Rh factor has no moral value. As far as research has revealed its nature, it is a biological reality, comparable in practically all respects, as far as morality goes, to any one of literally thousands of substances occurring in the human body, each effecting a biological result in the biological economy of the organism, each conditioning the general well being of the organism and each either essential or necessary or desirable in the organism. Whether we are Rh positive or Rh negative is not a matter of morality any more than whether we belong to any one of the four recognized blood groups.

In what sense, therefore, do we speak of the moral aspects of the Rh factor? In this very obvious sense, that the possession of the Rh factor or its absence in either the mother or the father has been made the occasion or excuse (a) for contraception, (b) for abortion, (c) for radical obstetrics, and (d) for preferential mating involving the conduct of engaged couples or of those who might plan to be engaged. The morality associated with the Rh factor arises from the use which a physician might make of his scientific knowledge in guiding individuals either in married life or outside of it; or it arises from the use which a man or woman might himself or herself make of the knowledge concerning the Rh factor in his or her conduct.

I.

Can the Rh factor justifiably be made an occasion for contraceptive practices? Before we answer this very important question, let us recall that in accordance with the teachings of the Church and the findings of sound ethics, the practices of contraception are contrary not only to divine but also to natural law. Onanistic practices are admittedly forbidden in the Jewish as well as the Christian revelation but they are equally forbidden by reason of the conclusions of the reasonable dictates of the human mind as it supplies materials for the judgment of conscience which direct the individual human being in his daily conduct. This is not the place nor the occasion for arguing this point. It is, however, the place and the occasion for guarding ourselves against fallacious conclusions even though these might be sincerely dictated in any given set of circumstances by seeming sympathy for a young married couple who, so it is alleged, are kept apart by reason of the fear of the possible consequences of the enjoyment of those experiences to which the sacrament of Matrimony has given them the full right of enjoyment. A young married couple has an uneventful but intensely happy experience in the birth of their first child. The second child is born sickly with symptoms that are today but too easily recognized. The health of the child wanes and the child dies. The third child might be stillborn and premature; the fourth might survive the threats of delivery but may present a pitiable appearance with its characteristic facial habitus or, which God may forbid, its continuous convulsive state, and its accompanying mental retardation.

We may paint the picture as black as we will. A physician is seen in each of these deliveries. If he is not aware or chooses not to be aware of the moral obligation of such a couple, whether they be Catholics or non-Catholics makes no difference, since we are dealing with a precept of the natural law, except that only Catholic couples will worry and be anxious about their obligations, he will counsel the application of one of his favorite contraceptive devices. It is here that the moral aspects of the Rh factor come into play. The physician insists that there may be no more children but since it is beyond all human expectation that the married couple will practice that self-restraint through which alone the physician's injunction can be made a reality, the physician simply dismisses his patients with the advice that they themselves are the only ones who can prevent the occurrence of another pathological child.

There can be no doubt about the reality which I am here trying to picture nor can there be doubt about the essential seriousness of the situation and of the almost super-human demand which ethical living makes upon some married couples. But after all, what essential factors are there in this situation that are not present in countless others in which continence is demanded by the moral law if other consequences, fateful though they be, are to be avoided?

The physician puts this married couple, through his advice, into the dilemma either of enjoying their rights or of accepting the consequences of another stillborn or pathological child. Be it noted that if the married couple accepts the alternative of continuing to enjoy their rights, there is no certainty that a pathological offspring or a stillborn fetus will eventuate. Rather, if we can accept statistics, diseased and healthy children may follow each other in a variable and hitherto undetermined sequence. Many a healthy child of a multipara has been born after a pathological or stillborn child and as far as the Rh factor is concerned, both biological considerations as well as statistical experience bear out the correctness of the contention that statistically, the birth of a healthy child might well be expected after the occurrence of the diseased or pathological member of the family. Neither the occurrence of a positive or negative father with a negative or positive mother nor the incidence of two parents who are both Rh negatives can give any certainty as to the expectations of either a pathological or normal offspring. Furthermore, the early post partum recognition and competent intensive treatment if the disease is resulting in a reputed reduction in mortality and an increase in clinical cures. If, therefore contraceptive advice is given prior to conception of the offspring and merely on the occurrence of a negative Rh test in the mother, the advice would seem to be unjustifiable; if it is given after the birth of a pathological child, it is given on a false presumption that the next child must certainly or probably be pathological.

I know that this logic, no matter how strict it may be, and incontravertible by reason of its cogency, does not solve some deeply human problems in which the threat to the continued integrity of the marriage bond of two well-intentioned and ardent Catholic young people might be endangered by a series of catastrophic events, each more poignant in its grief for father and mother than its predecessor. But again, let me point out, that contraception is no answer to the reality of the sufferings endured by a young married couple under those conditions; rather must the couple be safeguarded and strengthened and protected against the inroads of a false philosophy of life which would see in physical suffering the deepest and greatest of all human misfortunes and which would neglect for such a misfortune the sublime teachings of Christ Who by word and example taught the inexhaustible sublimity of human suffering, the ennobling character of agony endured for His sake and Who upon the Cross gave us the significant example of His three hours of loneliness in the midst of the hootings and cries of the assembled multitude. It seems cruel, but a couple having had such experiences cannot be encouraged to abuse their marital rights but must be taught how wisely, prudently and circumspectly they may enjoy those rights, but always within the law established by God.

II.

Can knowledge concerning the Rh factor be used to encourage interruption of pregnancy by abortion in order to prevent the live birth of an erythroblastic child? Concerning actual practice with reference to this question, there is little if any positive and accurate information. Surmizes, however, are uncomfortably frequent. Suggestions have been made by some physicians, though scarcely in published papers, that this matter be approached in the same way as one would approach therapeutic abortion, namely, that adequate consultation be called and that only upon the agreement of the required number of consultants should the attending physician proceed. The thinking leads to a concept akin to the thought which might be expressed by such a phrase as "therapeutic euthanasia," that is, the prevention of continuous life of a fetus which would or might or could result in a pathological child.

Such thinking is, of course, entirely unethical and must be judged ethically and morally by all the criteria and standards by reason of which we flatly condemn any other voluntary abortion, even therapeutic abortion, as generally understood. But in this case, there is even less biological or medical justification for the abortion than there is in other alleged necessary abortions since we do not possess the knowledge that would justify such a procedure even if it were ethically and medically allowable. It is well known that we do not have any way of judging prior to birth just what the hematological conditions of the fetus is. Even the most careful study of the mother's blood during the entire period of pregnancy cannot yield a conclusion concerning the probable or possible occurrence of an erythroblastic child. A demonstration of sensitization of the Rh-negative mother during pregnancy may mean and probably does mean the development of an erythroblastic infant but the degree, extent or precise nature of the pathology cannot be judged directly from the findings concerning the sensitization of the mother's blood. Besides, even when increases in the mother's sensitization are demonstrated, healthy Rh-positive births may result.

If this is correct, there can be no medical reason which I can see for counselling abortion in the case of the pregnancy of a sensitized Rh mother. There is, therefore, no medical reason for applying to the problem of the moral liceity of abortion any other considerations than those which apply to abortions in general. The principle which the Catholic physician follows in judging of such liceity are well known, are recognized by Catholics and non-Catholics alike. Abortions are finding less and less medical justification as medical research progresses and we are approaching in this question, the statement which marks the remarkable culmination of so many other questions in medicine in which conflicts were thought to exist between the medical and the moral viewpoints. I refer to the dictum which to my mind needs continuous re-emphasis, namely, that good moral practice is good medical practice and good medical practice is good moral practice, and that if there is an elleged or apparent conflict between morality and medicine, it is because the physician does not know his medicine or the moralist does not know his moral theology or his ethics. It seems unnecessary to labor this point because the ethical and moral arguments against abortion are well understood and are easily applied to our present problems.

III.

Can knowledge concerning the Rh factor justify radical obstetrics? The answer to this question must be approached quite differently from the answer to the previous one for the simple reason that Cesarian section is often the approach of choice for the physician who is confronted with a difficult moral problem in medical practice and who desires to solve that problem in accordance with the dictates of natural or revealed morality. Nevertheless, even though Cesarian section under certain conditions is ethically and morally permissible, it must still be regarded as an unusual obstetrical procedure which requires medical justification as the basis for its moral justification. It is unnecessary here to amplify this statement but the statement itself does recall ever so many of the physician's obligations with reference to the practice of surgery, gynecology, obstetrics and of all the other related surgical procedures. A Catholic physician will be mindful of all these considerations. An unnecessary operation is morally unjustifiable. Moreover, often must an elective operation be submitted to the most careful scrutiny and the most careful application of moral and medical criteria before it may be ethically performed. Endangering the life of a patient unnecessarily, mutilating the patient, causing the patient unnecessary expense and delay in a hospital with the attending anxieties and worries for herself and her family, all these and literally hundreds of other considerations enter into the problem of justifying an operation. For this reason, the many safeguards which we employ to ensure good surgical practice, such as, the recording of a pre-operative diagnosis, the submission of all biopsied tissues to the pathological laboratory, the pathologist's corroboration or non-corroboration of the pre-operative diagnosis, the review of the operative procedure in history meetings and in the clinical pathological conferences, all these and related procedures are at the same time safeguards of good surgical practice and of good moral practice and constitute the serious concern of any physician who takes seriously the sublime vocation of medicine and its supreme demands upon the moral integrity of the medical practitioner.

Applying this thinking to the problem in hand, there have been medical advisors and consultants who have counselled the interruption of pregnancy by Cesarian section in the last few weeks of pregnancy, such judgment being based upon the serological detection of increased sentitization of the mother as pregnancy progressed.

We may revert here to our comments made in the previous section of this paper. If the theories upon which our present thinking is based are correct and if there is a relationship between the acuity and intensity of the disease in the fetus and the relative amount of the antibodies detectable in the mother's blood which in some way find their way through the placental wall, it would seem that Cesarian section and the consequent liberation of the premature fetus from the threat of the massing of antibodies in the fetal circulation would seem to be the approach of choice for the prevention of progressive erythroblastosis. Following this line of reasoning, the suggestion has been made that as soon as the developing fetus is viable, it should be delivered by radical obstetrics to prevent the progressive accumulation of antibodies derived from the mother's circulation.

But warnings have been issued against this over-simplification. The literature is becoming more and more complex as the result of an increasing amount of research and our failure to comprehend how the results of such research will be integrated in the final synthesis of our knowledge. A recent editorial in the Journal of the American Medical Association warns us that: "There is little to recommend Cesarian section as a means of saving babies with erythroblastosis. Too many disappointments have been experienced. The handicap of prematurity is rarely outweighed by the alleged shortening of exposure to the damaging action of maternal Rh antibodies." (J.A.M.A., November 9, 1946, page 581). The editorial goes on to express the same thought which I have attempted to express in the previous section: "The crux seems to be our inability thus far to recognize with certainty the severity of the disease in the baby by the examination of the mother's blood." (Ibid.).

IV.

The approach to the last question which I have raised, namely, what bearing our knowledge of the Rh factor has upon pre-marital advice concerning courtship and the possible moral problems involved in the choice of a partner, reaches out even beyond the immediate interests of medical practice into the recondite areas of human heredity. It would seem almost foolhardy to enter upon a discussion of the moral problems associated with all of this at a moment like the present when certainly the required time for discussing these matters is surely not at our disposal. And yet perhaps, a few generalizations may be considered tentative and entirely anticipatory of the confirmation of present day findings by future research.

Some conclusions bearing upon the matter in hand are even today not only probable but almost approach scientific certainty. There can be no reasonable question any longer in anyone's mind concerning the occurrence in the blood cells of certain individuals of a factor in the nature of an agglutinogen which has been named the Rh factor and which is not related to any one of the known and recognized blood types. Evidence is also accumulating to an extent that is most impressive that while Rh-negative individuals mating together and Rh-positive individuals mating together need not anticipate, except under conditions recognized by the human geneticist and in this case, by the human immunologist, the birth of an erythroblastic child, the mating of a Rh-negative female with a Rh-positive male may result in a small but still important percentage of instances in an erythroblastic child. When a Rh-negative female mating with a Rh-positive male, no untowards results in the way of an erythroblastic first child need be anticipated unless the mother has been sensitized at almost any time in her pre-pregnancy life by the transfusion of Rh-positive blood through which transfusion she has produced antibodies to Rh-positive blood. The anticipation with regard to subsequent children is, of course, entirely different.

All of these statements would have to be modified to make them rigorously correct, for the complexity of the geno-type of the Rh-positive factor has been a matter of intense research not only by the original group of investigators, namely, Landsteiner and Wiener, but also by the British investigators working in Race's laboratory. Race has recognized the occurrence of a complicated allelomorphic series of seven mutations in the Rh gene. We know that the gene occurs in some other than the sex chromosome and, therefore, the occurrence of the factor in the red cells is not sex linked which fact introduces additional complications into the study of the heredity of the Rh factor. It is true that evidence is accumulating to show that erythroblastosis occurs in the male in about three times the frequency in which it occurs in the female and that it is fatal in about five times as many male infants as in female infants but these facts may be secondary even though the possibility cannot be disregarded that we are dealing with some kind of modification of a sex linked characteristic, or possibly with some kind of secondary consequence of the male constitution.

If one now bears in mind that we are in all likelihood dealing with seven allelomorphs which we refer to as Rh_1, Rh_2, Rh_0, Rh^1, Rh^{11}, rh and Rhy and that any one of these may occur in each of the pair of allelomorphic chromosome, it is not surprising that the complexity here runs well into the hundreds of possible combinations on this score alone. If we add to this the occurrence of the Hr factor and its possible series of allelomorphs, we have an extremely complicated picture before us.

I am entering into these details merely to show how futile it would be to use any of this information at the present time as a basis of pre-marital advising regarding human mating. I wish to emphasize the thought too, that anticipatory fears regarding matings based upon the possible occurrence of erythroblastic infants, certainly outrun the present day findings of scientific research. They should not, therefore, and must not be made the basis of moral judgments. Advice cannot be justified that a Rh-negative girl should not marry a Rh-positive man even if it were known that the girl has previously received transfusions. Least of all would it be justified to forbid such a marriage on moral grounds for fear that the result of a pregnancy might be an erythroblastic infant. Of course, I cannot sanction the advice which has allegedly been given by some birth control clinics that such matings as the one I am here discussing should be allowed because if an erythroblastic child should occur, there are ways of dealing with the situation as I have tried to indicate above.

Clearly, it is not my place here to enter into a discussion of the therapeutics of the erythroblastic infant. There is, however, one phase of the question which demands a sufficiently thorough understanding on the part of the physician if he is to give the advice required by the gravity of the Problem. Blood transfusions to the erythroblastic infant are usually given from Rh negative donors. Evidence is accumulating and opinion is consolidating that in many instances transfusion of Rh-positive blood should be the procedure of preference. In this connection, I would point out that advice given by the physician implies the moral obligation of maintaining competence in those fields in which the physician has cast his medical practice. There enter here those extremely exacting instances in which a physician must balance scientific likelihood against certain moral obligation, when we say, for example, "Let your conscience be your guide," but the important thing to note is that before we apply conscience to some of these vexed problems, we must be able to apply a well informed mind to the problems, so that conscience might be ready to pass its moral judgment. I am tempted to leave this phase of the question at this point but it would be unfair to do so both to my own thinking and perhaps to this audience.

We must remember, first of all, that not every marriage of a Rh-negative woman with a Rh-positive man results in erythroblastic infants. In the words of the Journal of the American Medical Association: "Only one in from twenty-five to fifty Rh-negative wives of Rh-positive husbands become sensitized to the Rh factor and give birth to babies with erythroblastosis." In the light of this fact, the promotion of sensational group fears is certainly far from justified. Even if erythroblastic children occurred, there is every hope that through accumulating knowledge and research, problems related to the moral aspects of suspected Rh matings will yield to scientific research. It is heartening that large scale studies, such as those undertaken by the Baltimore Rh Typing Laboratory, are in progress. The service of this laboratory for a relatively small fee is accessible to the patients of any of the hospitals of Baltimore and to any applicant. Blood groupings are determined and Rh typing is attempted. Samples of blood giving positive reactions are screened. Those giving negative or doubtful reactions are further tested. The serum of all patients showing Rh-negative blood are tested for antibody content. The husbands of women having Rh negative blood are requested to come to the laboratory for typing. If they are found to be Rh-positive, further studies are made to determine the geno-type of their Rh-positive character. Families thus selected are followed during the entire period of pregnancy without additional cost. During the first six months, the tests are repeated monthly and more frequently during the last three months. The reports are sent to the physician of the couple and when necessary, the officials of the laboratory advise with the physician concerning the further conduct of the pregnancy. Assuming, as we do in this case, competence, sincerity, a truly social purpose elevated by a moral purpose, the approach is surely correct. From such studies we may expect conservatism and security of outlook, the avoidance of sensationalism, the maintenance of proper secrecy in diffusing privileged information and, most of all, the furtherance of the therapeutic problems in dealing with the erythroblastic infant.

V.

This paper must be regarded as a premature but sincere approach to the definition of the moral problems connected with the Rh factor. I have tried to show that our present knowledge concerning the Rh factor cannot be taken as an excuse for propagandizing for contraception, neither can it be taken as an occasion for reducing our moral abhorence for abortion. It would seem, moreover, that any knowledge which we now have of the Rh factor cannot justify a diminution of our attitudes of scientific and moral caution towards radical obstetrics.

Finally, I see no justification for pre-marital advice which would prevent the marriage of even those men and women in whom we recognize the occurrence of those Rh types from which admittedly the larger percentage of erythroblastic children have been derived. This latter judgment is based upon the presumed occurrence of erythroblastic children even from other than the more commonly recognized mating and upon the fact that an impressive percentage of allegedly erythroblastic infants, upon autopsy, are found to have died from other causes than Rh factor crossings.

And yet, when all is said and done, erythroblastic infants have occurred and families have been destined to carry the overwhelming cross of pathological infants and the brothers and sisters of such infants have been confronted even in their tender childhood with the sorrows of a relative whose condition is a challenge to human endurance, patience and kindliness. All this is true and yet, it cannot be made the basis for any of those immoral and unethical practices to which we have referred, it cannot be made the excuse for infant euthanasia. If we permitted such immoral or unethical practices in the case of erythroblastic infants, there would soon be pleadings concerning mothers who have contracted pelves who have endured abruptio placentae and before long, there would be given to us by medical authority perhaps or by administrative authority, a long list of conditions which would be deemed "intolerable" in civilized society.

For us who have faith, there is another solution. Suffering is not an unmixed evil. An erythroblastic infant is destined for the eternal bliss of heaven as much as any other infant; the parents and brothers and sisters of such a child may be blessed because that child may be for each of them the occasion of graces and blessings untold for God's glorification and their own eternal salvation. The erythroblastic infant was included in Christ's invitation and perhaps it might have been chiefly included: "Suffer the little children to come unto Me and forbid them not for of such is the kingdom of God."

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MORAL ASPECTS OF ARTIFICIAL INSEMINATION

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THE BACKGROUND

WITHIN the last decade many articles concerning the morality of artificial insemination have been published in Catholic theological journals. The purpose of the present article is to summarize and briefly explain the main conclusions reached in these articles and the opinions expressed in the most recent manuals of moral theology. This topic was treated in the January, 1940, number of THE LINACRE QUARTERLY by Dr. Dayton H. O'Donnell, of Detroit; but, since the subject is still a live one and since much has been written about it in the last few years, a new and practical survey of the question should be helpful to doctors who wish to know and to follow the correct moral doctrine.

We can begin with a consideration of the case which is most frequently proposed by the advocates of artificial insemination: namely, the impregnation of a married woman by sperm obtained from a man who is not her husband. Every Catholic theologian would unhesitatingly brand this operation, in its totality, as immoral; both the impregnation itself and the method of obtaining the sperm are against the law of nature.

It should be rather obvious that we know the plan of nature by analysing the nature of things. God's plan for human propagation must be judged according to human nature and not according to mere animal nature. And whatever may be said of cats and dogs and horses, the well-being of the human child normally demands the care of father and mother over a considerable number of years. Because this fact was always clear to them Catholic philosophers have held unwaveringly to the principle that a re-productive act is permissible only between two persons who are united in the firm bond of marriage. Marriage is the only contract that gives the child the guaranty of father-mother care that his nature demands. The fact that some other man will promise to care for the child is a poor substitute for the plan of nature and is in itself quite contrary to that plan.

Briefly, therefore, we may say that the Catholic philosopher condemns the impregnation of a woman by a man who is not her husband because this act is against nature's plan for the education of the child. This principle has been taken over unchanged by Catholic theology; and it was stated very clearly and very beautifully by Pius XI in his encyclical on Christian Marriage. After having spoken of the parents' duties to beget and rear children, the Pope solemnly added:

> "Nor must we omit to remark, in fine, that since the duty entrusted to parents for the good of their children is of such high dignity and of such great importance, every use of the faculty given by God for the procreation of new life is the right and the privilege of the marriage state alone, by the law of God and of nature, and must be confined absolutely within the sacred limits of that state."

By way of brief comment on this papal declaration, I might mention that when the Pope uses the expression "by the law of God and of nature" he is using technical theological language. The "law of God" refers to the divine law as manifested in revelation, and the "law of nature" refers to the divine law as expressed in the nature of things! In other words, he says that both revelation and reason teach us that reproductive activity must be confined to the marriage state. Since the woman who allows herself to be impregnated by the sperm of a man other than her own lawful husband is really exercising her procreative power with that man, even though this is not being done in the usual manner, she is violating this divine law; and all who assist her share in her guilt according to the measure of their cooperation.

PROCEDURES

I mentioned that, with regard to the case we are considering, Catholic theologians would condemn not only the impregnation itself but also the standard method of obtaining the sperm. With an almost absolute unanimity Catholic moralists have always held that masturbation is against the divine law as manifested both by revelation and by reason, and that this law admits of no exceptions. Their argument from revelation is principally based on St. Paul, who says that "Effeminates . . . . shall not inherit the kingdom of heaven" (cf. I Corinthians, Ch. 6). The earliest Christian tradition interpreted this expression "effeminates" (the Latin word is *molles*) as referring to those practicing self-abuse—an interpretation which squares perfectly with the context, in which various sins of impurity are enumerated.

In proving that masturbation is against the natural law, Catholic moralists have advanced various arguments, the simplest of which, I believe, is based on an analysis of the physical sex mechanism. According to this argument, the very configuration of the male and female bodies, and the biological processes pertaining to reproduction make it quite clear that the psycho-physical processes are directed to and find their natural fulfillment only in coitus. Solitary orgasm makes a mockery of this entire mechanism. Furthermore, if a purely solitary act is not against nature, then no other act in the sex area is against nature; there are no perversions, and there is no natural basis for sex morality. That, of course, is just the conclusion that modern materialism wishes us to reach; but one can reach such a conclusion only by blinding oneself to nature's obvious plan.

A few centuries ago, a theologian who came to be known as "the prince of laxists" because of the unusual opinions he defended, advanced the view that masturbation is not against the natural law. The Holy See promptly condemned his opinion. It is worthy of note that even this man was not trying to justify masturbation; he admitted that divine revelation forbids it, and he was simply contending that it is not against the law of nature. Another unusual opinion of about the same period seems to have been occasioned by an obvious error in biology to the effect that semen, if retained, might "corrupt" and thus become poisonous and threaten life. It seems that a few theologians held that, if this were the case and if there were no other way of getting rid of the "poisoned semen," a man might masturbate in order to remove the "corrupted semen" and thus "save his life."

With such isolated exceptions as these, Catholic moralists have always held that masturbation is against the law of nature and that this law admits of no exceptions. It may interest our medical men if I point out here that such constant and uniform teaching has a two-fold value, even independently of the arguments used by the moralists. In the first place, it certainly has the same *scientific* value as would be had, for instance, in legal matters if through generations and even through centuries eminent judges would constantly and day after day hand down the same decision concerning some point of law. A lawyer of today would hardly be considered as unreasonable if he accepted such decisions as expressions of a sound principle of law, even though he had great personal difficulty is appreciating the underlying reasons. And on the other hand, the lawyer would be considered quite rash if he were to reject such a traditional and unanimous judicial opinion without exceptionally solid reasons for doing so.

THEOLOGICAL OPINION

What these judges are to the science of law the moral theologians are to the science of morality. No other society or religious body in the world so emphatically encourages or so carefully trains moral experts as the Catholic Church. For the most part, others merely dabble in moral science; very few genuinely specialize in it. Moreover, anyone who is conversant with moral theology can testify that Catholic moralists do not make a habit of agreeing with one another. There have been and are many controversies among Catholics—for example, on ectopic operations and, as I shall point out presently, on certain aspects of artificial insemination between husband and wife. Hence a view that is held unanimously over a long period of time has a strong presumption in its favor, even from the merely scientific point of view.

Such teaching is also of great *religious* significance to the Catholic. For if theologians unanimously and over a long period of time were to teach erroneously some matter of faith or morals, this teaching would inevitably infect the teaching Church itself—something which is impossible. Hence, the uniform and constant teaching of theologians in such matters is a sure sign of the approval of the Church. That the Church does approve their teaching was indicated by the condemnation previously referred to and also by a reply of the Sacred Congregation of the Holy Office given in 1929, which stated that direct masturbation is not permitted even for the detection and cure of a contagious disease.

Reasons Against Artificial Insemination

The arguments I have given thus far show why the Catholic moralist cannot in any way approve of the artificial impregnation of a married woman by the sperm of a man who is not her husband; and the same arguments show why no moralist, even a non-Catholic, *should approve* of the practice. For what is against nature is wrong for everyone, and this can be known by the light of reason. To these arguments, we might add certain considerations which, if they do not of themselves show the immorality of the "proxy" father practice, at least render it suspect.

In the first place, there is the simple fact that a child conceived by means of a "proxy" father is a potential source of strife in any family. Normally a child is a bond of union. He satisfies both the maternal and paternal instincts, gives to father and mother a sense of achievement, and strengthens the bond of love between husband and wife. Such is nature's plan. The child by a "proxy" father is apt to produce effects that are quite the contrary. The enthusiasts for artificial insemination say that this is an ungrounded fear of armchair moralists; and they aver that such children have brought great happiness to couples that would otherwise be childless. They admit, however, that they cannot point to many cases because these matters must of necessity be kept secret. To prove their assertion, they would have to adduce many cases and would have to show that the personalities involved are not "abnormal."

Materialistic and Liberal Views

Another reason for suspecting the practice is the fact that it makes a logical piece with the false philosophy that has long been working for the degradation of the family. Two of the ingredients of this false philosophy are a crude liberalism which claims for every man the "right to be happy" (which really means the right to do as one pleases) and sheer materialism, which in denying the spiritual, puts man on the same plane as brute animals. This is not the place to expound the harm already done by this false philosophy; but those who wish to have a panoramic view of its devastating effects would do well to read Leclercs' *Marriage and the Family.* At present, I merely wish to point out that the same subversive principles seem to underlie the "proxy" father propaganda. The couple want a child, therefore, let them have it in any way they wish. And, since artificial insemination is a good way of breeding animals, it should be satisfactory for men, too!

ARTIFICIAL INSEMINATION-WIFE AND HUSBAND

I have dwelt at some length on this first case because it is the one most commonly spoken of. The second case concerns the impregnation of a married women by the sperm of her own husband. The question might be practical when a married couple, otherwise fertile, are prevented from having children because of anatomical or physiological anomalies. My reference to this case will be very brief and is intended merely to inform doctors of the present status of the question in theological literature. In speaking of the various methods of insemination I am not attempting to pronounce on their medical value. I might mention, however, that the impression gained from my study of the problem is that it is very difficult to find a method which is both medically satisfactory and morally permissible.

Theologians often refer to a case in which the husband and wife have natural intercourse, but with little probabilty of conception because of anatomical or other difficulties. In such a case, practically all Catholic moralists will allow the doctor to lend artificial aid, either by correcting the structural defect or by facilitating the passage of the semen into the uterus. There is some controversy among moralists even on this matter but it is slight and can readily be ignored. Most theologians do not even consider this to be genuine artificial insemination.

Insemination is clearly artificial when the husband's sperm is obtained by some means which is a substitute for intercourse. Many theologians are of the opinion that this is never lawful. They argue that the rights of married people are determined entirely by their marriage contract; and the object of this contract is coitus. Any other means of reproduction is outside the contract and beyond the rights even of married people. These theologians think that when the Holy Office condemned artificial insemination is 1897 it condemned all forms of artificial insemination.

Those holding this first opinion are moralists of the highest reputation, and their arguments are very strong. Nevertheless, an equal number of authoritative moralists are not convinced by these arguments and are of the opinion that artificial impregnation is permissible for married people, provided the husband's sperm is obtained in a manner morally unobjectionable. They think that the decree of the Holy Office refers only to cases in which the sperm is obtained by an unnatural act.

The moralists who sponsor this second opinion do not hold that either husband or wife would be obliged to take part in an artificial impregnation, even though licit means were used; rather, they consider it to be an extraordinary means of propagation which the married couple may resort to by mutual consent. And of course, they would not say that an artificial impregnation consummates a marriage.

THE SOLUTION OF A CONTROVERSY

This controversy may go on for some time, and it may be settled within a short time by the Holy See. In practice, until the dispute is settled, Catholic doctors may follow the opinion that artificial insemination between husband and wife is permissible, if the husband's sperm can be obtained in a morally unobjectionable manner. I am sure that, if medical men discover or have discovered more such methods, the moral theologian will welcome the opportunity for evaluating their morality.

In conclusion, we may refer in passing to a sentimental problem sometimes proposed: namely, the case of the unmarried woman who wants to have a child of her own by means of artificial insemination. The answer to this case has already been given; no woman has a right to bear a child by any man except by her own lawful husband.

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